Laid-open specification

DE 196 45 503 A1

Motor vehicle having a luggage space

The invention relates to a motor vehicle (1) having a luggage space (4) which is equipped with devices (8, 16) for securing items of luggage or similar loads (9). In order to inform and remind a driver of the motor vehicle (1) of the need to secure heavy and bulky articles (9) when transporting the latter, the motor vehicle (1) has at least one load sensor (12, 18) which is arranged in the luggage space (4) and responds to the presence of loads (9), and an indicating apparatus which is connected to the load sensor (12, 18) and is preferably activated if the weight or the dimensions of the load (9) exceed predefined values. A signalling sensor (25), which responds to the securing devices (8, 16) being used, prevents the indicating apparatus from being activated if the load (9) has been secured.

Description

The invention relates to a motor vehicle having a luggage space which is provided with devices for securing items of luggage or similar loads.

A motor vehicle of this type is known from European patent application 95 101 549, publication number 0 670 244 A1. The securing devices there consist of one or more securing belts which can be tensioned over one or possibly a plurality of items of luggage in order to securely tie them in a predefined position. The aim of this is to increase the safety of passengers seated on the rear seats of the vehicle by preventing the load from moving forward at high-speed in the direction of travel in the event of a frontal collision and injuring the passengers in the vehicle. The types of vehicle in which securing devices such as these can be used include, in principle, passenger vehicles such as sedan cars, vans, buses and the like, and also a very wide variety of industrial vehicles.

In principle, it is also possible to use other devices in place of the securing belts, for example securing nets or telescopic rods which are provided with compression springs and are braced above the items of luggage between the walls of the luggage space.

However, a driver often does not secure the articles being transported despite the available devices, either because he has forgotten to or due to laziness or because he has underestimated the potential for danger of not securing them.

Taking the above as a starting point, the invention is based on the object of improving motor vehicles of the type mentioned in the introduction to the effect that the driver can be informed or reminded of the need to

secure heavy articles when transporting the latter.

According to the invention, this object is achieved by at least one load sensor which is arranged in the luggage space and responds to the presence of loads, and an indicating apparatus which is connected to the load sensor and informs the driver by means of a visual and/or acoustic signal that the load should be secured. The presence of loads which are being carried in the luggage space can be determined by sensors in a very wide variety of ways, but in the invention preference is given to the use of load sensors which allow activation of the indicating apparatus to be based on the weight or the size of the load, in order to prevent relatively light or small articles which are being carried in the luggage space from causing the indicating apparatus to be activated, so that the driver does not give sufficient consideration to said apparatus.

A first particularly preferred refinement of the invention provides for the load sensor to respond to the weight of the load and activate the indicating apparatus if the weight of the load determined by the load sensor exceeds a predefined value which, according to the experience the motor-vehicle manufacturer, requires the load to be secured or for which securing of the load would at least seem advisable.

In order to accommodate the load sensor in the luggage space in such a way that it takes up little space, can be fitted without the need for any structural changes and measures the weight of the articles being transported irrespective of how they are arranged, one preferred refinement of the invention provides for a flat pressure sensor to be arranged on the floor of the luggage space. The pressure sensor is preferably designed as a thin membrane-type pressure sensor whose resistance changes when a force acting on the load

sensor changes. Membrane-type pressure sensors are composed of two separate polymer layers which lie one above the other, one polymer layer being coated with a semiconductor material and the other polymer layer bearing two conductor tracks on its surface which engage one in the other in the manner of a comb, said surface resting against the semiconductor material and said sensors being commercially available under this name. If pressure is applied to one or more locations on the membrane-type pressure sensor, the conductor tracks are electrically connected at these locations via the semiconductor material, as a result of which the resistance between the two conductor tracks decreases essentially in proportion to the pressure and therefore also to the force produced by the weight of an item of luggage resting on the membrane-type pressure sensor.

A further preferred refinement of the invention provides for the membrane-type pressure sensor to be integrated in a carpet on the floor of the luggage space, in order on the one hand to protect said sensor from damage and on the other hand to ensure simple installation without additional components.

The membrane-type pressure sensor may cover the floor of the luggage space entirely or partially, in the latter case the conductor tracks preferably being distributed essentially uniformly over the surface of the floor. In this case, the change in resistance compared to an initial value in the unloaded state is multiplied by a factor which is given by the proportion of the total surface area of the floor of the luggage space which is covered by the membrane-type pressure sensor. The multiplication is expediently performed in an electronic evaluation circuit which is connected to the load sensor and to the indicating apparatus.

Alternatively, a plurality of individual membrane-type

pressure sensors may also be arranged next to one another on the floor of the luggage space, the indicating apparatus providing the driver with a visual and/or acoustic signal if the pressure on one of the membrane-type pressure sensors or the total pressure on all of the membrane-type pressure sensors exceeds a predefined value in each case.

As an alternative to membrane-type pressure sensors, it is in principle also possible to use pressure sensors which contain liquid-filled channels, which are connected to a pressure pickup cell or another apparatus for measuring the pressure of a liquid, and a transducer in which the measured value is converted into an electrical signal.

According to a further preferred refinement of the invention, the load sensor, which responds to the weight of the load, and the indicating apparatus may also be used to indicate to the driver the risk of the permissible axial load on the axle beneath the luggage space being exceeded by that proportion of the unloaded weight which is exerted on this axle being added to the weight of the load which is determined by the load sensor in each case in the evaluation circuit which is preferably in the form of a microcomputer, and the indicating apparatus being activated when a predefined limiting value is exceeded.

In contrast, a second particularly preferred refinement of the invention provides for the load sensor to determine the dimensions of the load by optical means and to activate the indicating device when the load has or exceeds specific dimensions. In this case, the load sensor preferably comprises a plurality of optical transmitters and optical receivers distributed in the luggage space, a predefined change in the radiation incident on the receiver causing the indicating apparatus to be activated. According to a first

variant, the transmitters and receivers are arranged opposite one another in pairs and form optical barriers, the interruption of which activates the indicating apparatus. As an alternative to this, the transmitters and receivers may be arranged next to one another, in this case the intensity of radiation emitted into the luggage space by the transmitter and reflected in the luggage space to the receiver being compared with a value stored in the evaluation electronics, and the indicating apparatus being activated when a predefined difference value is exceeded. That is to say, an active trigonometric multiple distance measurement takes place from one side of the luggage space toward the opposite side, with changes in the distance being detected by comparing the measured values with stored values and being transmitted in the form of activation signals to the indicating apparatus when predefined threshold values are exceeded.

Since the intention is that the indicating apparatus will no longer be activated once the load has been secured, a further preferred refinement of the invention provides for at least one signalling sensor to be integrated in the securing devices, this signalling sensor transmitting different signals to the electronic evaluation device depending on whether the securing device is in use or not. Said evaluation device activates the indicating apparatus only if a signal from the load sensor indicates that a load is present in the luggage space and a signal from the signalling sensor indicates that the securing devices are not in use.

The signalling sensor may expediently be a switch which is integrated in a lashing lug of the securing devices and interrupts an electrical circuit between the signalling sensor and the evaluation device when the lashing lug is in use, and thus prevents activation of

the indicating apparatus. In order to ensure that the electrical circuit is interrupted only when the lashing lug is in use, said lashing lug automatically moves into a non-use position if no external forces are acting on it, and the electrical circuit is closed. The automatic movement is preferably performed with the aid of a spring which presses the lashing lug into a recess in the floor or in the wall of the luggage space when said lug is not in use.

The text which follows explains the invention in greater detail with reference to several exemplary embodiments which are schematically illustrated in the drawing, in which:

fig.1 shows a plan view from above of a luggage space of a passenger vehicle having a securing device for loads in the form of securing belts and a load sensor which is designed as a pressure sensor;

fig.2 shows a sectional view of the luggage space along the line 2-2 in fig. 1;

fig. 3 shows a sectional view similar to that in fig. 2, but with an optical load sensor being used;

fig. 4 shows a sectional view similar to that in figs 2 and 3, but with another optical load sensor being used;

fig. 5 shows a plan view similar to that in fig. 1, but having a securing device in the form of a securing net and lashing lugs with signalling sensors;

fig. 6 shows an enlarged plan view from above of a lashing lug with a signalling sensor; and

fig. 7 shows an enlarged sectional view though the lashing lug along the line 7-7 in fig. 6.

The motor vehicle 1, only part of which is illustrated in the drawing and which here is in the form of a passenger vehicle, has a luggage space 4 behind a divided backrest 2 of its rear-seat bench 3, it being possible to close this luggage space to the rear by means of a tailgate which is not illustrated. There is a flat cylindrical recess 5 for a spare wheel beneath the luggage space 4 and the top of this recess is closed off by a carpet 6 which covers the entire floor 7 of the luggage space.

Securing devices for loads are provided within the luggage space 4 and, in the exemplary embodiment in figs 1 and 2, comprise three securing belts 8 which are fitted to the front end of the luggage space 4 directly behind the backrest 2 in order to secure items of luggage or another load 9. The free ends of the securing belts 8 are provided with belt-buckle connectors 10 which allow the belts 8 to be shortened or lengthened and which can each be inserted into one of three belt buckles 11. The belt buckles 11 are fastened to short belt ends 14 at the rear liftgate 15 so that the belts 8 can be tensioned parallel to one another in the direction of travel or in such a way that they cross over one another over the load 9 situated in the luggage space 4, in order to hold this load firmly in its position.

In contrast to this, the securing devices in the exemplary embodiment illustrated in figs 5 and 6 comprise a securing net 16 which can be fastened to already present lashing lugs 19 with the aid of four or more straps 17 having integrated tensioning apparatus, in order to firmly hold the load in position on the floor of the luggage space 4. The lashing lugs 19 are pivotably mounted in recesses 27 in the floor 7 of the luggage space and, respectively, by mounts 28 which are fastened to the sides of the spring strut domes, with a torsion spring 29 which is fitted in the region of a

pivot axis 31 between the lashing lug 19 and the boundaries of the recess 27 in each case pressing the lashing lug 19 into the recess 27 if no external force is acting on the lashing lug 19.

Due to the fact that, despite the presence of the securing belts 8 or of the securing net 16, the driver often forgets to secure the luggage loaded into the luggage space 4 against sliding, and because the driver frequently underestimates the weight of the load 9 and the risk presented by this in the event of a frontal collision, the luggage space 4 is equipped with a load sensor which detects the presence of loads 9 in the luggage space 4.

In the exemplary embodiment illustrated in figs 1 and 2, the load sensor is a membrane-type pressure sensor 12 which responds to the pressure exerted by the force of the weight of the load 9 on the carpet 6 and/or to a change in this pressure compared to an unloaded state with no pressure exerted.

The membrane-type pressure sensor 12 comprises two thin polymer layers which are arranged one above the other, the upper layer of which is coated with a semiconductor material on its lower side, whereas the lower layer has two conductor tracks on its upper side which are each connected to a separate connection and extend at defined distances from one another, these conductor tracks preferably engaging one in the other in the manner of a comb. In the unloaded state, the membrane-type pressure sensor 12 has a relatively large resistance between the two connections, and when a load is placed on the membrane-type pressure sensor perpendicularly to the plane of the conductor tracks said resistance decreases approximately in proportion to the load by two to three powers of ten since at the loaded locations the semiconductor material is connected in parallel between the conductor tracks, as

a result of which the resistance between them decreases.

The membrane-type pressure sensor 12 is integrated in the carpet 6 and arranged between a lower relatively rigid support layer 13 and an upper cover layer of the latter in order to reduce the risk of damage.

The two connections of the membrane-type pressure sensor 12 are connected to an electronic evaluation circuit (not illustrated) which, depending on the complexity of the operations to be performed, may consist of several switching elements or of a microcomputer, or is integrated in an on-board computer of the motor vehicle 1. The evaluation circuit is connected to an indicating apparatus (not illustrated) which, for example, is formed by a warning lamp on the instrument panel of the motor vehicle 1 and/or by a buzzer.

In the evaluation circuit, the change in the electrical resistance of the membrane-type pressure sensor 12 and/or the change in a small current flowing through the conductor tracks of said sensor are/is measured as a consequence of one or more items of luggage 9 being placed on the carpet 6. When a predefined limiting value is exceeded, an electrical circuit of the indicating apparatus is closed in the evaluation circuit and the indicating apparatus is thus activated if an ignition key is in the ignition lock of the motor vehicle 1 or is subsequently inserted. No current is supplied to the indicating apparatus if the ignition key is not inserted.

The limiting value may, for example, be set such that the indicating apparatus is always activated when the total weight of the load 9 exceeds approximately 20 to 30 kg.

In contrast to this, the exemplary embodiments illustrated in figs 3 and 4 use optical means to determine whether a load 9 transported in the luggage space 4 exceeds predefined dimensions and should therefore expediently be secured. Here, the load sensors are designed as optical sensors 18 and each comprise a plurality of IR transmitters 20 in the form of LEDs and IR receivers 21 in the form of photodetectors which contain IR phototransistors or IR photodiodes.

In the exemplary embodiment illustrated in fig. 3, the transmitters 20 and receivers 21 (not illustrated) are each arranged in pairs at a predefined height above the carpet 6 on opposite side walls 22 of the luggage space 4, said transmitters and receivers forming a plurality of parallel light barriers, one or more of which is/are interrupted when the height of the load 9 transported in the luggage space 4 exceeds the height of the light barriers. The interruption of one of the light barriers produces an electrical signal in an electrical circuit between the evaluation circuit and the receivers 21, this electrical signal leading to activation of the indicating apparatus.

In contrast, the transmitters 20 and/or receivers 21 in the exemplary embodiment illustrated in fig. 4 are fitted one above the other in pairs on the rear liftgate 15 and distributed over the width thereof, the transmitters 20 being formed by individual LEDs, whereas the receivers 21 are designed as photodetector arrays and in each case comprise a plurality of individual detectors. During operation, the LEDs emit short pulses of light having a pulse length of from 0.2 to 5 ms which are reflected at the boundary walls of the luggage space 4 and at the transported load 9 and are received by the photodetectors of the photodetector arrays which are ready to receive. As a basis for activation of the indicating apparatus, the sensors 18

are firstly activated when the luggage space 4 is empty, and the intensity of the radiation which is incident on the photodetectors and is reflected by the boundary walls of the luggage space 4 is determined at each photodetector. These intensity values are converted into proportional voltage signals and stored in a memory of the evaluation circuit such that they are associated with the individual photodetectors. These stored values are later compared with values which are in each case measured at the photodetectors after the ignition key has been inserted into the ignition lock and activation of the optical load sensor 18 has thus been triggered. A load 9 transported in the luggage space 4 changes the distance between the reflection surfaces and the transmitters 20 and/or receivers 21, as a result of which the intensity of the incident radiation also changes. When a predefined difference value is exceeded, the indicating apparatus is activated.

The evaluation circuit may contain a time-lag relay which interrupts the electrical circuit of the indicating apparatus again when a predefined time period expires, for example 2 to 5 minutes after insertion of the ignition key into the ignition lock, so that activation of the indicating apparatus is terminated even if the load 9 has not been securely tied in the meantime.

In order to prevent the indicating apparatus from being activated once the load 9 has been secured, in the exemplary embodiment illustrated in figs 5 to 7, a signalling sensor 25 is integrated in each of the recesses 27 in the lashing lugs 19, this signalling sensor being formed by an electrical switch 30 in the base of the recess 27. The mechanically, capacitively or inductively triggered switch 30 interrupts an electrical circuit, which leads to the evaluation circuit, when the lashing lug 19 protrudes out of the

recess counter to the force of the torsion spring 29 and/or is at a specific distance from the base of the recess, this only being the case when the securing net 16 is correctly fitted over the load 9 and the straps 17 are tensioned.

The indicating apparatus is activated only when, firstly, the lashing lug 19 is in the recess 27 and the electrical circuit is thus closed, and secondly when a load sensor 12 or 18 (not illustrated in figs 5 to 7) which is arranged in the luggage space 4 signals the presence of a load 9 in the luggage space 4, or better still responds, when said load exceeds a predefined weight and/or predefined dimensions.

This type of feedback is also possible in the exemplary embodiment illustrated in figs 1 and 2 by the belt buckles 11 being provided with electrical contacts in the form of signalling sensors 25 in a similar manner to those of known passenger seatbelts, said signalling sensors being bridged when the belt-buckle connector 25 10 are inserted into the belt buckle 11, and the electrical circuit of the indicating apparatus then being interrupted by the evaluation circuit so that the indicating apparatus is not activated.

Since, in this case, the indicating apparatus does not however indicate when the belt-buckle connectors 10 are actually in the belt buckles 11 but the securing belts 8 are lying loosely beside or on the load 9, it is also possible to provide, in place of the interrupter contacts in the belt buckles 11, other signalling sensors which, for example, are integrated in the securing belts 8 in the form of wire strain gauges and interrupt the electrical circuit of the indicating apparatus only when the securing belts 8 are tensioned and the wire strain gauges are thus extended by a predefined amount.

Patent claims

1. A motor vehicle (1) having a luggage space which is provided with devices for securing items of luggage or similar loads, distinguished by at least one load sensor (12, 18) which is arranged in the luggage space (4) and responds to the presence of loads (9), and an indicating apparatus which is connected to the load sensor (12, 18).

2. The motor vehicle (1) as claimed in claim 1, wherein the load sensor (12) is a flat pressure sensor which is arranged on a floor (7) of the luggage space (4) and responds to the weight of the load.

3. The motor vehicle (1) as claimed in claim 1 or 2, wherein the load sensor (12) is a membrane-type pressure sensor.

4. The motor vehicle (1) as claimed in claim 1 or 2, wherein the load sensor has cavities which are filled with a liquid and are connected to a pressure-measuring apparatus.

5. The motor vehicle (1) as claimed in claim 3 or 4, wherein the load sensor (12) essentially covers the floor (7) of the luggage space (4).

6. The motor vehicle (1) as claimed in one of claims 3 to 5, wherein the load sensor (12) is integrated in a carpet (6) on the floor of the luggage space (4).

7. The motor vehicle (1) as claimed in one of claims 1 to 6, wherein the indicating apparatus indicates that a predefined limiting value for a total weight of the load (9) is exceeded.

8. The motor vehicle (1) as claimed in one of claims

1 to 7, distinguished by evaluation electronics which are connected to the load sensor (12) and to the indicating apparatus.

9. The motor vehicle (1) as claimed in one of claims 1 to 8, wherein a plurality of load sensors are distributed over the floor (7) of the luggage space (4).

10. The motor vehicle (1) as claimed in claim 9, wherein the indicating apparatus indicates both that a predefined limiting value for an individual weight acting on one of the load sensors is exceeded, and also indicates that a predefined limiting value for a total weight of the load is exceeded.

11. The motor vehicle (1) as claimed in one of claims 8 to 10, wherein, when an ignition key is inserted into an ignition lock of the motor vehicle (1), an electrical circuit of the indicating apparatus is closed by the evaluation electronics if the weight of the load (9) exceeds a predefined limiting value.

12. The motor vehicle (1) as claimed in claim 11, distinguished by a time-lag relay which interrupts the electrical circuit of the indicating apparatus when a predefined time period expires after the ignition key has been inserted.

13. The motor vehicle (1) as claimed in claim 1 or 12, wherein the load sensor (18) comprises at least one optical transmitter (20) and at least one optical receiver (21) and evaluation electronics.

14. The motor vehicle (1) as claimed in claim 13, wherein the load sensor (18) responds to the change in radiation emitted into the luggage space (4) by the transmitter (20) and reflected in the luggage space (4) to the receiver (21).

15. The motor vehicle (1) as claimed in claim 14, wherein the evaluation electronics compare in each case two intensity signals which are produced by a receiver (21) in response to the incident radiation and/or are stored in the evaluation electronics.

16. The motor vehicle (1) as claimed in one of claims 13 to 15, wherein the receiver (21) comprises a multiplicity of photodetectors.

17. The motor vehicle (1) as claimed in one of claims 13 to 16, wherein the transmitter (20) comprises a multiplicity of light-emitting diodes which are arranged on a boundary wall of the luggage space (4).

18. The motor vehicle (1) as claimed in claim 13, wherein the transmitter (20) and the receiver (21) are designed as optical barriers.

19. The motor vehicle (1) as claimed in one of claims 1 to 18, distinguished by at least one signalling sensor (25) which is integrated in the securing devices (8, 16) and responds when the securing devices (8, 16) are not in use.

20. The motor vehicle (1) as claimed in claim 19, wherein the indicating apparatus is activated if a signal from the load sensor (12, 18) indicates the presence of loads (9) in the luggage space (4) and a signal from the signalling sensor (25) indicates that the securing devices (8, 16) are not in use.

21. The motor vehicle (1) as claimed in claim 19 or 20, wherein the signalling sensor (25) is a switch (30) which interacts with a lashing lug (19).

22. The motor vehicle (1) as claimed in claim 21, wherein the lashing lug (19) automatically moves into a

rest position when it is not in use, and causes the switch (30) to switch.

4 pages of associated drawings

DRAWINGS PAGE 1 Number: DE 196 45 503 A1
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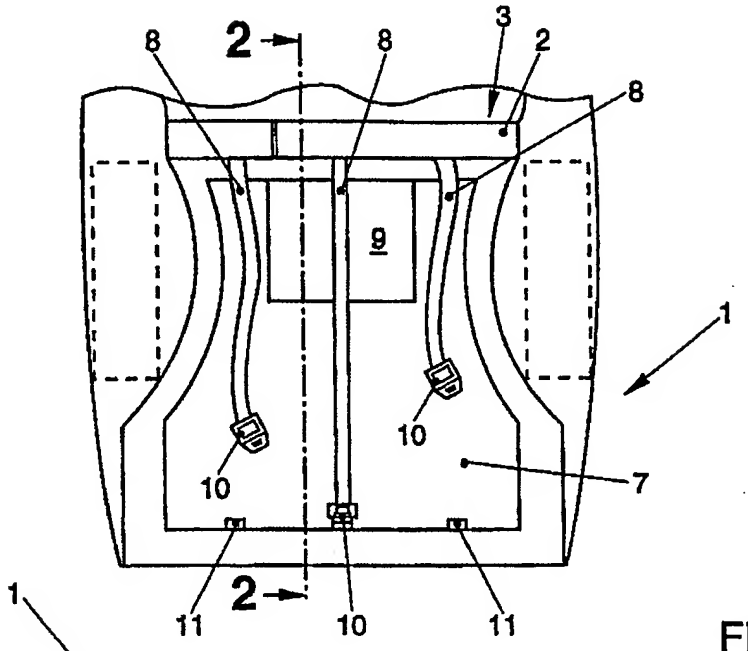

FIG. 1

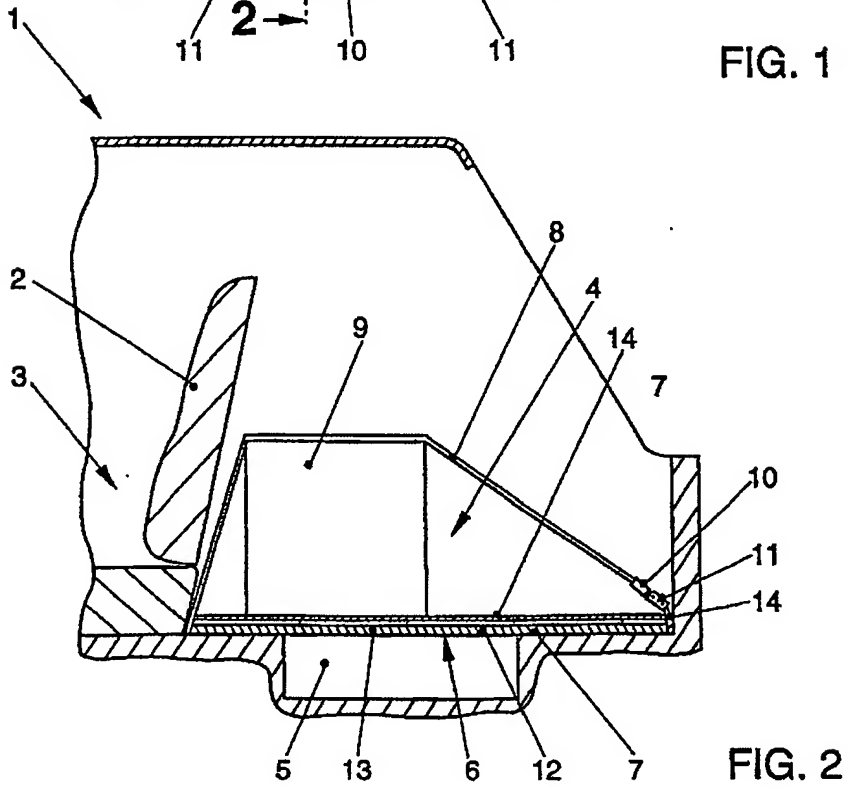

FIG. 2

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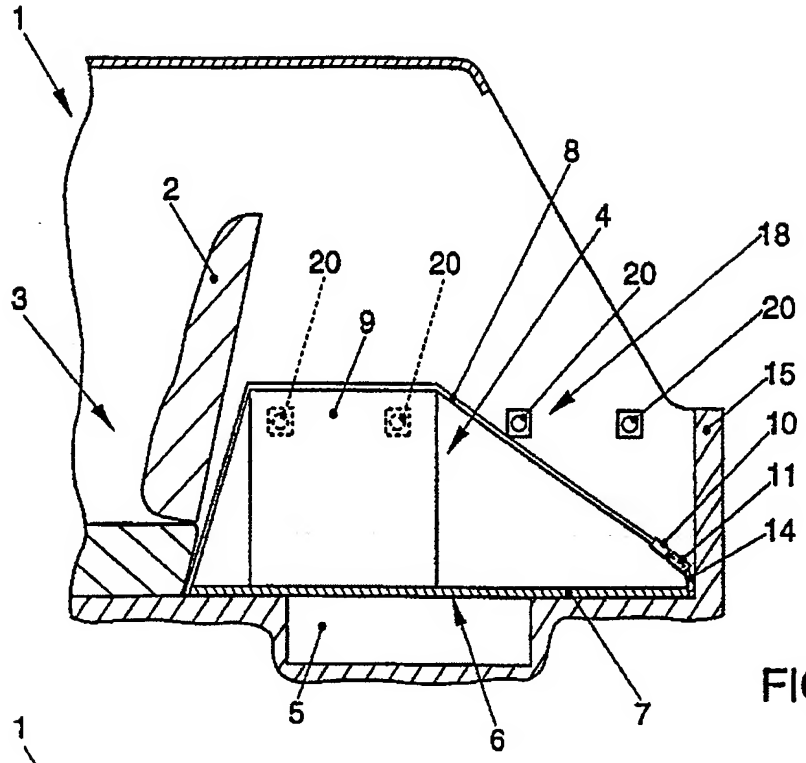

FIG. 3

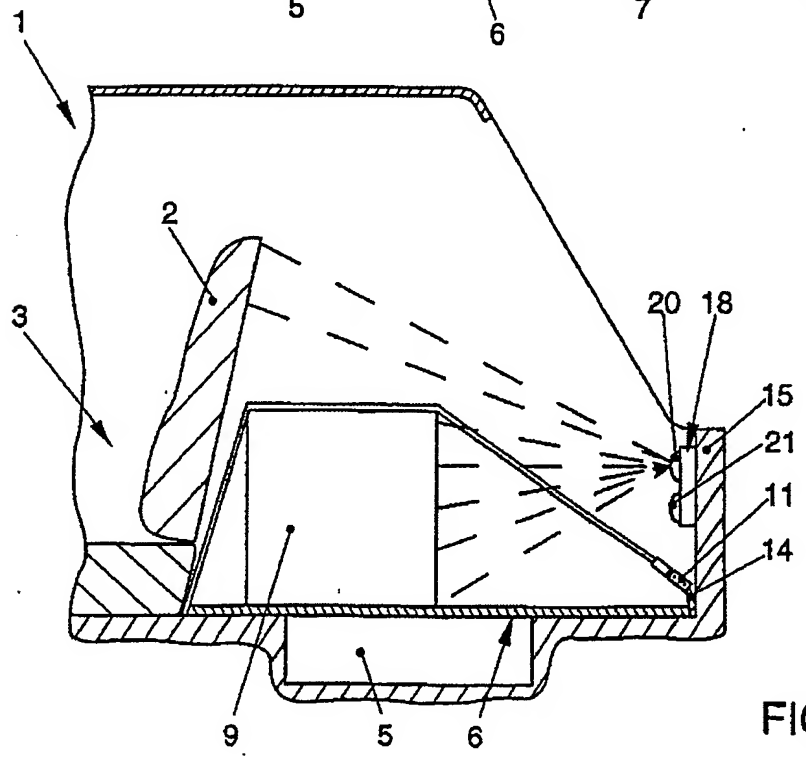

FIG. 4

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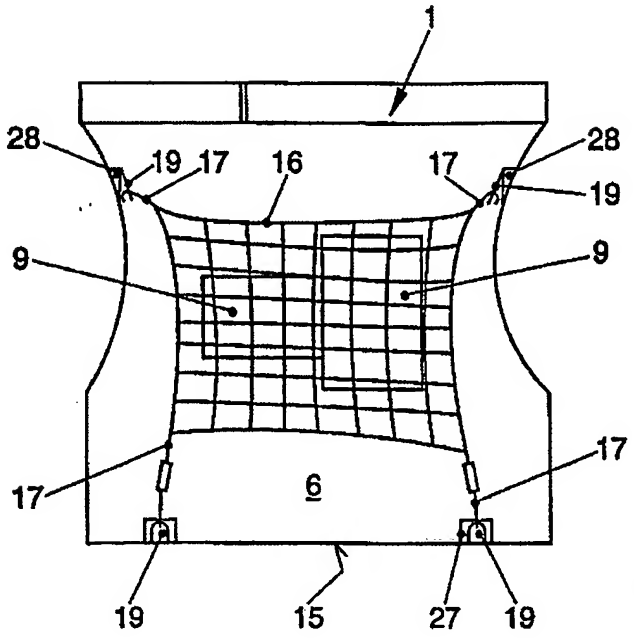

FIG. 5

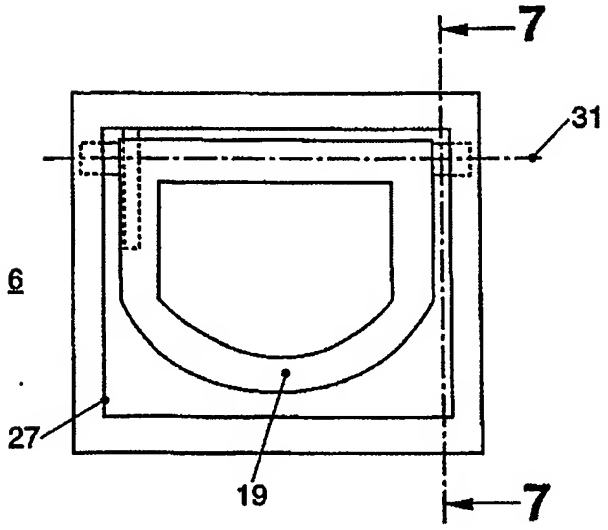

FIG. 6

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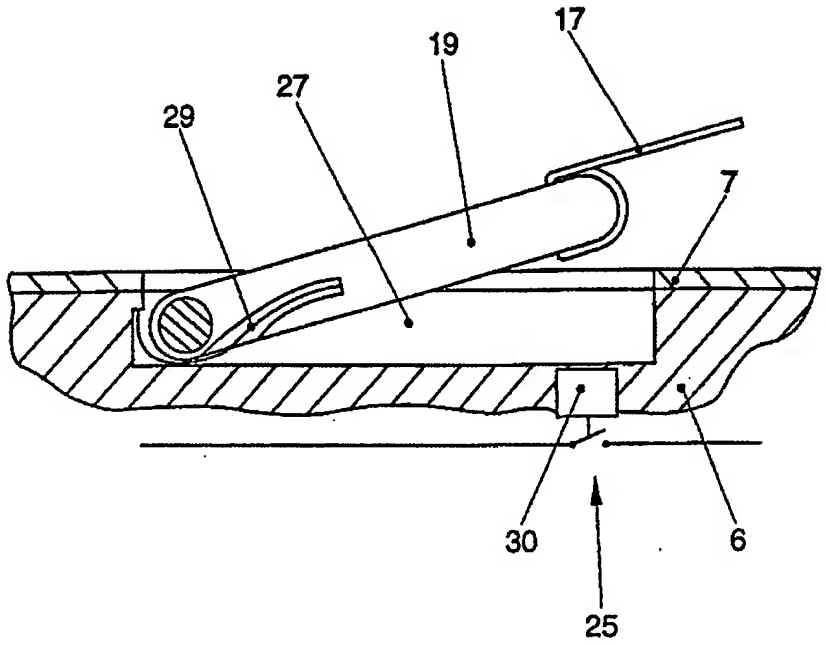

FIG. 7